

SEQUENCE LISTING

(1) GENERAL INFORMATION:

- (i) APPLICANT: Graham, Laurie A.
Liou, Yih-Cherng
Walker, Virginia K.
Davies, Peter L.
- (ii) TITLE OF INVENTION: Tenebrio Antifreeze Proteins
- (iii) NUMBER OF SEQUENCES: 22
- (iv) CORRESPONDENCE ADDRESS:
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(C) CITY: San Francisco
(D) STATE: California
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(F) ZIP: 94111-3834
- (v) COMPUTER READABLE FORM:
(A) MEDIUM TYPE: Floppy disk
(B) COMPUTER: IBM PC compatible
(C) OPERATING SYSTEM: PC-DOS/MS-DOS
(D) SOFTWARE: PatentIn Release #1.0, Version #1.30
- (vi) CURRENT APPLICATION DATA:
(A) APPLICATION NUMBER: US 08/882,907
(B) FILING DATE: 26-JUN-1997
(C) CLASSIFICATION:
- (viii) ATTORNEY/AGENT INFORMATION:
(A) NAME: Weber, Kenneth A.
(B) REGISTRATION NUMBER: 31,677
(C) REFERENCE/DOCKET NUMBER: 016252-002100US
- (ix) TELECOMMUNICATION INFORMATION:
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- (2) INFORMATION FOR SEQ ID NO:1:
- (i) SEQUENCE CHARACTERISTICS:
(A) LENGTH: 12 amino acids
(B) TYPE: amino acid
(C) STRANDEDNESS:
(D) TOPOLOGY: linear
- (ii) MOLECULE TYPE: peptide
- (ix) FEATURE:
(A) NAME/KEY: Peptide
(B) LOCATION: 1..12
(D) OTHER INFORMATION: /note= "consensus 12 amino acid repeating motif"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:1:

Cys Thr Xaa Ser Xaa Xaa Cys Xaa Xaa Ala Xaa Thr
 1 5 10

(2) INFORMATION FOR SEQ ID NO:2:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 68 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..68
- (D) OTHER INFORMATION: /note= "conserved N-terminal region of thermal hysteresis protein (THP) isoforms"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:2:

TGCACTGGGG STGCTGATTG YACTAGTTGT ACAGVWGCAT GCACTGGTTG TGGAARYTGT 60
 CCAAATGC 68

(2) INFORMATION FOR SEQ ID NO:3:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 16 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: peptide

(ix) FEATURE:

- (A) NAME/KEY: Peptide
- (B) LOCATION: 1..16
- (D) OTHER INFORMATION: /note= "consensus 16 amino acid N-terminal motif for YL-1, YL-2, YL-3 and YL-4"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:3:

Xaa Cys Thr Xaa Xaa Xaa Xaa Cys Thr Xaa Cys Thr Xaa Xaa Cys Thr
 1 5 10 15

(2) INFORMATION FOR SEQ ID NO:4:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 24 amino acids
- (B) TYPE: amino acid
- (C) STRANDEDNESS:
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: peptide

(ix) FEATURE:

- (A) NAME/KEY: Peptide
- (B) LOCATION: 1..24
- (D) OTHER INFORMATION: /note= "N-terminal amino acid sequence of YL-1, YL-2, YL-3 and YL-4"

(ix) FEATURE:

- (A) NAME/KEY: Modified-site
- (B) LOCATION: 1
- (D) OTHER INFORMATION: /product= "OTHER"
/note= "Xaa = Gln or His"

(ix) FEATURE:

- (A) NAME/KEY: Modified-site
- (B) LOCATION: 5
- (D) OTHER INFORMATION: /product= "OTHER"
/note= "Xaa = Ala or Gly"

(ix) FEATURE:

- (A) NAME/KEY: Modified-site
- (B) LOCATION: 13
- (D) OTHER INFORMATION: /product= "OTHER"
/note= "Xaa = Ala, Asp or Gly"

(ix) FEATURE:

- (A) NAME/KEY: Modified-site
- (B) LOCATION: 20
- (D) OTHER INFORMATION: /product= "OTHER"
/note= "Xaa = Asn or Ser"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:4:

Xaa Cys Thr Gly Xaa Ala Asp Cys Thr Ser Cys Thr Xaa Ala Cys Thr
 1 5 10 15
 Gly Cys Gly Xaa Cys Pro Asn Ala
 20

(2) INFORMATION FOR SEQ ID NO:5:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 61 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..61
- (D) OTHER INFORMATION: /note= "conserved C-terminal region of thermal hysteresis protein (THP) isoforms"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:5:

CTCAACCAAC TGTTACAAAG CTACAGCCTG TACCAATTCA WCAGGATGTC CCGGACATTA 60
R 61

(2) INFORMATION FOR SEQ ID NO:6:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 32 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..32
- (D) OTHER INFORMATION: /note= "PCR primer"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:6:

CATATGCATA TGCAATGCAC TGGGGGTGCT GA 32

(2) INFORMATION FOR SEQ ID NO:7:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 32 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..32
- (D) OTHER INFORMATION: /note= "PCR primer"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:7:

AAGCCTAAGC TTTTAATGTC CGGGACATCC TG 32

(2) INFORMATION FOR SEQ ID NO:8:

- (i) SEQUENCE CHARACTERISTICS:
 (A) LENGTH: 18 base pairs
 (B) TYPE: nucleic acid
 (C) STRANDEDNESS: single
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
 (B) LOCATION: 1..18
 (D) OTHER INFORMATION: /note= "internal downstream facing
 sequencing primer"

Q₁₀
(xi) SEQUENCE DESCRIPTION: SEQ ID NO:8:

AAAGACTGTT TTGAAGCC

18

(2) INFORMATION FOR SEQ ID NO:9:

- (i) SEQUENCE CHARACTERISTICS:
 (A) LENGTH: 18 base pairs
 (B) TYPE: nucleic acid
 (C) STRANDEDNESS: single
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

- (A) NAME/KEY: -
 (B) LOCATION: 1..18
 (D) OTHER INFORMATION: /note= "internal upstream facing
 sequencing primer"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:9:

TTCAAAACAG TCTTTTGA

18

(2) INFORMATION FOR SEQ ID NO:10:

- (i) SEQUENCE CHARACTERISTICS:
 (A) LENGTH: 559 base pairs
 (B) TYPE: nucleic acid
 (C) STRANDEDNESS: single
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(ix) FEATURE:

- (A) NAME/KEY: -
 (B) LOCATION: 1..559
 (D) OTHER INFORMATION: /note= "YL-1 thermal hysteresis protein
 (THP) cDNA from Tenebrio molitor"

(ix) FEATURE:

- (A) NAME/KEY: CDS
 (B) LOCATION: 37..375
 (D) OTHER INFORMATION: /product= "YL-1"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:10:

TAAACAGCGA GATAACAAC AATACTACAT AAAACT ATG GCG TTC AAA ACG TGT 54
 Met Ala Phe Lys Thr Cys
 1 5

GGT TTT TCA AAA AAA TGG TTA GTA ATA GCA GTT ATA GTT ATG TGT TTG 102
 Gly Phe Ser Lys Lys Trp Leu Val Ile Ala Val Ile Val Met Cys Leu
 10 15 20

TGT ACC GAG TGT TAT TGC CAC TGC ACT GGG GGT GCT GAT TGT ACT AGT 150
 Cys Thr Glu Cys Tyr Cys His Cys Thr Gly Gly Ala Asp Cys Thr Ser
 25 30 35

TGT ACA GAT GCA TGC ACT GGT TGT GGA AAT TGT CCA AAT GCA CAT ACG 198
 Cys Thr Asp Ala Cys Thr Gly Cys Gly Asn Cys Pro Asn Ala His Thr
 40 45 50

TGT ACC GAT TCC AAA AAT TGT GTC AAG GCA GCA ACA TGT ACT GGA TCT 246
 Cys Thr Asp Ser Lys Asn Cys Val Lys Ala Ala Thr Cys Thr Gly Ser
 55 60 65 70

ACA AAA TGT AAT ACC GCC AGG ACG TGT ACA AAC TCA AAA GAC TGT TTT 294
 Thr Lys Cys Asn Thr Ala Arg Thr Cys Thr Asn Ser Lys Asp Cys Phe
 75 80 85

GAA GCC AAA ACA TGT ACT GAC TCA ACC AAC TGT TAC AAA GCT ACA GCC 342
 Glu Ala Lys Thr Cys Thr Asp Ser Thr Asn Cys Tyr Lys Ala Thr Ala
 90 95 100

TGT ACC AAT TCA ACA GGA TGT CCC GGA CAT TAAGTTTTTC TATTGTCAAC 392
 Cys Thr Asn Ser Thr Gly Cys Pro Gly His
 105 110

AATAATAAAA CACACTTACT GTTATCTTAG CTAAAACATA ATTGTAAGCT CACTCTGTTT 452

TGTATCCTAT CTGTCTCTGC CTCCGAAGGA TGATAATTTT GTACTGGGAG CGAAAGGTTT 512

ATCCGACAAT AATAAACTAA AATAATTGAT ATAAAAAAAA AAAAAAA 559

(2) INFORMATION FOR SEQ ID NO:11:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 112 amino acids
 (B) TYPE: amino acid
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:11:

Met Ala Phe Lys Thr Cys Gly Phe Ser Lys Lys Trp Leu Val Ile Ala
 1 5 10 15
 Val Ile Val Met Cys Leu Cys Thr Glu Cys Tyr Cys His Cys Thr Gly
 20 25 30
 Gly Ala Asp Cys Thr Ser Cys Thr Asp Ala Cys Thr Gly Cys Gly Asn
 35 40 45
 Cys Pro Asn Ala His Thr Cys Thr Asp Ser Lys Asn Cys Val Lys Ala
 50 55 60
 Ala Thr Cys Thr Gly Ser Thr Lys Cys Asn Thr Ala Arg Thr Cys Thr
 65 70 75 80
 Asn Ser Lys Asp Cys Phe Glu Ala Lys Thr Cys Thr Asp Ser Thr Asn
 85 90 95
 Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser Thr Gly Cys Pro Gly His
 100 105 110

(2) INFORMATION FOR SEQ ID NO:12:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 529 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..529
- (D) OTHER INFORMATION: /note= "YL-2 thermal hysteresis protein (THP) cDNA from Tenebrio molitor"

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 21..359
- (D) OTHER INFORMATION: /product= "YL-2"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:12:

AAACAATATT ACAAAAAACT ATG GCA TTC AAA ACG TGT GGT TTT TCA AAA 50
 Met Ala Phe Lys Thr Cys Gly Phe Ser Lys
 1 5 10
 AAA TGG TTA GTA ATA GCA GTT ATA GTT ATG TGT TTG TGT ACC GAG TGT 98
 Lys Trp Leu Val Ile Ala Val Ile Val Met Cys Leu Cys Thr Glu Cys
 15 20 25
 TAT TGC CAA TGC ACT GGG GGT GCT GAT TGC ACT AGT TGT ACA GGA GCA 146
 Tyr Cys Gln Cys Thr Gly Gly Ala Asp Cys Thr Ser Cys Thr Gly Ala
 30 35 40

TGC ACT GGT TGT GGA AAC TGT CCA AAT GCA GTA ACG TGT ACC AAT TCT 194
 Cys Thr Gly Cys Gly Asn Cys Pro Asn Ala Val Thr Cys Thr Asn Ser
 45 50 55
 CAA CAT TGT GTC AAG GCA AAT ACA TGT ACT GGG TCT ACA GAT TGT AAT 242
 Gln His Cys Val Lys Ala Asn Thr Cys Thr Gly Ser Thr Asp Cys Asn
 60 65 70
 ACA GCC CAG ACG TGT ACA AAC TCA AAA GAC TGT TTT GAA GCC AAC ACA 290
 Thr Ala Gln Thr Cys Thr Asn Ser Lys Asp Cys Phe Glu Ala Asn Thr
 75 80 85 90
 TGT ACT GAC TCA ACC AAC TGT TAC AAA GCT ACA GCC TGT ACC AAT TCA 338
 Cys Thr Asp Ser Thr Asn Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser
 95 100 105
 TCA GGA TGT CCC GGA CAT TAAGTTTTTC TATTGTCAAC AATCATAAAA 386
 Ser Gly Cys Pro Gly His
 110
 CACAATTATT GTTAGCTAAG TTAAAACTCT GTATTGTATC CGATCTGTCT CTTTGCCTCC 446
 CAAGGATGAT AATTTTGTAC TGGGAGCGAA AGGGTTATCG GACAATAATA AACTAAAATA 506
 ATTGATATAA AAAAAAAAAA AAA 529

(2) INFORMATION FOR SEQ ID NO:13:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 112 amino acids
 (B) TYPE: amino acid
 (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:13:

Met Ala Phe Lys Thr Cys Gly Phe Ser Lys Lys Trp Leu Val Ile Ala
 1 5 10 15
 Val Ile Val Met Cys Leu Cys Thr Glu Cys Tyr Cys Gln Cys Thr Gly
 20 25 30
 Gly Ala Asp Cys Thr Ser Cys Thr Gly Ala Cys Thr Gly Cys Gly Asn
 35 40 45
 Cys Pro Asn Ala Val Thr Cys Thr Asn Ser Gln His Cys Val Lys Ala
 50 55 60
 Asn Thr Cys Thr Gly Ser Thr Asp Cys Asn Thr Ala Gln Thr Cys Thr
 65 70 75 80
 Asn Ser Lys Asp Cys Phe Glu Ala Asn Thr Cys Thr Asp Ser Thr Asn
 85 90 95
 Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser Ser Gly Cys Pro Gly His
 100 105 110

(2) INFORMATION FOR SEQ ID NO:14:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 642 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..642
- (D) OTHER INFORMATION: /note= "YL-4 thermal hysteresis protein (THP) cDNA from Tenebrio molitor"

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 10..456
- (D) OTHER INFORMATION: /product= "YL-4"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:14:

CAAAAAAGT ATG TCA TTC AAA ATA AGT ACT TTT ACA AAA ATC TGG TTA 48
 Met Ser Phe Lys Ile Ser Thr Phe Thr Lys Ile Trp Leu
 1 5 10

ATT ATA GCA GTT ATC GTT ATG TGT TTG TGT AAC GAG TAT AAT TGC CAG 96
 Ile Ile Ala Val Ile Val Met Cys Leu Cys Asn Glu Tyr Asn Cys Gln
 15 20 25

TGC ACT GGG GCT GCT GAT TGT ACT AGT TGT ACA GCA GCA TGC ACT GGT 144
 Cys Thr Gly Ala Ala Asp Cys Thr Ser Cys Thr Ala Ala Cys Thr Gly
 30 35 40 45

TGT GGA AAC TGT CCA AAT GCA ATA ACG TGT ACC GGT TCT AAA AAT TGT 192
 Cys Gly Asn Cys Pro Asn Ala Ile Thr Cys Thr Gly Ser Lys Asn Cys
 50 55 60

GTC AGG GCA ACA ACA TGT ACT GGG TCT ACA AAC TGT AAT AGA GCC ACG 240
 Val Arg Ala Thr Cys Thr Gly Ser Thr Asn Cys Asn Arg Ala Thr
 65 70 75

ACG TGT ACA AAT TCA AAA GGC TGT TTA GAA GCC ACA ACA TGT ACT GGG 288
 Thr Cys Thr Asn Ser Lys Gly Cys Leu Glu Ala Thr Thr Cys Thr Gly
 80 85 90

TCT ACA CAC TGT CAT AGA GCC ACG ACG TGT ACA AAT TCA AAA GAC TGT 336
 Ser Thr His Cys His Arg Ala Thr Thr Cys Thr Asn Ser Lys Asp Cys
 95 100 105

TTT GAA GCC ACA ACA TGT ACT GGC TCA AGC AAC TGT TAC ACT GCT ACA 384
 Phe Glu Ala Thr Thr Cys Thr Gly Ser Ser Asn Cys Tyr Thr Ala Thr
 110 115 120 125

ACA TGT ACT AAC TCA ACC AAC TGT TAC AAA GCT ACA GCC TGT ACC AAT 432
 Thr Cys Thr Asn Ser Thr Asn Cys Tyr Lys Ala Thr Ala Cys Thr Asn
 130 135 140

TCA ACA GGA TGT CCC GGA CAT TAGGTTTTT TATTGTCAAC AATAAAATAA 483
 Ser Thr Gly Cys Pro Gly His
 145

AACAAACTG TTCTTATCTA AGCTAAAACA TAAATGTAAA CGTTAATTG TATTCTATCC 543

GATCTGTCCC TTTGCGCCCT AAGGATAATT TTGTACAGGG AGAGAAAAGG CTATCGGACA 603

ATAATAACA TTGTTAATAT ACATAAAAAA AAAAAAAAAA 642

(2) INFORMATION FOR SEQ ID NO:15:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 148 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:15:

Met Ser Phe Lys Ile Ser Thr Phe Thr Lys Ile Trp Leu Ile Ile Ala
 1 5 10 15
 Val Ile Val Met Cys Leu Cys Asn Glu Tyr Asn Cys Gln Cys Thr Gly
 20 25 30
 Ala Ala Asp Cys Thr Ser Cys Thr Ala Ala Cys Thr Gly Cys Gly Asn
 35 40 45
 Cys Pro Asn Ala Ile Thr Cys Thr Gly Ser Lys Asn Cys Val Arg Ala
 50 55 60
 Thr Thr Cys Thr Gly Ser Thr Asn Cys Asn Arg Ala Thr Thr Cys Thr
 65 70 75 80
 Asn Ser Lys Gly Cys Leu Glu Ala Thr Thr Cys Thr Gly Ser Thr His
 85 90 95
 Cys His Arg Ala Thr Thr Cys Thr Asn Ser Lys Asp Cys Phe Glu Ala
 100 105 110
 Thr Thr Cys Thr Gly Ser Ser Asn Cys Tyr Thr Ala Thr Thr Cys Thr
 115 120 125
 Asn Ser Thr Asn Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser Thr Gly
 130 135 140
 Cys Pro Gly His
 145

(2) INFORMATION FOR SEQ ID NO:16:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 587 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(ix) FEATURE:

(A) NAME/KEY: -

(B) LOCATION: 1..587

(D) OTHER INFORMATION: /note= "YL-3 thermal hysteresis protein
(THP) cDNA from Tenebrio molitor"

(ix) FEATURE:

(A) NAME/KEY: CDS

(B) LOCATION: 24..398

(D) OTHER INFORMATION: /product= "YL-3"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:16:

AAACAACAAT ATTACAAAAA ACT ATG GCA TTC AAA ACG TGT GGT TTT TCA 50
Met Ala Phe Lys Thr Cys Gly Phe Ser
1 5

AAA AAA TGG TTA ATA ATA GCA GTT ATA GTT ATG TGT TTG TGT ACC GAG 98
Lys Lys Trp Leu Ile Ile Ala Val Ile Val Met Cys Leu Cys Thr Glu
10 15 20 25

TGT TAT TGC CAA TGC ACT GGG GGT GCT GAT TGT ACT AGT TGT ACA GCA 146
Cys Tyr Cys Gln Cys Thr Gly Gly Ala Asp Cys Thr Ser Cys Thr Ala
30 35 40

GCA TGC ACT GGT TGT GGA AGT TGT CCA AAT GCG CAT ACG TGT ACC GAT 194
Ala Cys Thr Gly Cys Gly Ser Cys Pro Asn Ala His Thr Cys Thr Asp
45 50 55

TCT AAA AAT TGT GTC AGG GCA GAA ACG TGT ACC GAT TCT GAA AAT TGT 242
Ser Lys Asn Cys Val Arg Ala Glu Thr Cys Thr Asp Ser Glu Asn Cys
60 65 70

GTC AAG GCA CAT ACA TGT ACT GGA TCT AGA AAC TGT AAT ACA GCC ATG 290
Val Lys Ala His Thr Cys Thr Gly Ser Arg Asn Cys Asn Thr Ala Met
75 80 85

ACG TGT ACA AAC TCA AAA GAC TGT TTT GAA GCC AAA ACA TGT ACT GAC 338
Thr Cys Thr Asn Ser Lys Asp Cys Phe Glu Ala Lys Thr Cys Thr Asp
90 95 100 105

TCA ACC AAC TGT TAC AAA GCT ACA GCC TGT ACC AAT TCA ACA GGA TGT 386
Ser Thr Asn Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser Thr Gly Cys
110 115 120

CCC GGA CAT TAAGTTTTTC TATTGTCAAC AATAATAAAA CACGGAGGGA 435
Pro Gly His

TAGTCTAAGC TAAACATAA TTGTAAGCTT ACTCTGTATT GTATCCGATC TGTCTCTTTG 495

CCTCCAAGG ATGATAATTT TGTACTGGGA GCGAAAGGGT TACCGGACAA TAATAATTAA 555

TAAACTAAAT AATTGATAAA AAAAAAAAAA AA 587

(2) INFORMATION FOR SEQ ID NO:17:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 124 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:17:

Met Ala Phe Lys Thr Cys Gly Phe Ser Lys Lys Trp Leu Ile Ile Ala
 1 5 10 15
 Val Ile Val Met Cys Leu Cys Thr Glu Cys Tyr Cys Gln Cys Thr Gly
 20 25 30
 Gly Ala Asp Cys Thr Ser Cys Thr Ala Ala Cys Thr Gly Cys Gly Ser
 35 40 45
 Cys Pro Asn Ala His Thr Cys Thr Asp Ser Lys Asn Cys Val Arg Ala
 50 55 60
 Glu Thr Cys Thr Asp Ser Glu Asn Cys Val Lys Ala His Thr Cys Thr
 65 70 75 80
 Gly Ser Arg Asn Cys Asn Thr Ala Met Thr Cys Thr Asn Ser Lys Asp
 85 90 95
 Cys Phe Glu Ala Lys Thr Cys Thr Asp Ser Thr Asn Cys Tyr Lys Ala
 100 105 110
 Thr Ala Cys Thr Asn Ser Thr Gly Cys Pro Gly His
 115 120

(2) INFORMATION FOR SEQ ID NO:18:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 602 base pairs
- (B) TYPE: nucleic acid
- (C) STRANDEDNESS: single
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: cDNA

(ix) FEATURE:

- (A) NAME/KEY: -
- (B) LOCATION: 1..602
- (D) OTHER INFORMATION: /note= "5-15 cDNA"

(ix) FEATURE:

- (A) NAME/KEY: CDS
- (B) LOCATION: 36..410
- (D) OTHER INFORMATION: /product= "5-15"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:18:

AAACAGCGAG ATAAACAACA ATATTACAAA AAACAT ATG GCA TTC AAA ACG TGT 53
Met Ala Phe Lys Thr Cys
1 5

GGT TTT TCA AAA AAA TGG TTA ATA ATA GCA GTT ATA GTT ATG TGT TTG 101
Gly Phe Ser Lys Lys Trp Leu Ile Ile Ala Val Ile Val Met Cys Leu
10 15 20

TGT ACC GAG TGT TAT TGC CAA TGC ACT GGG GGT GCT GAT TGT ACT AGT 149
Cys Thr Glu Cys Tyr Cys Gln Cys Thr Gly Gly Ala Asp Cys Thr Ser
25 30 35

TGT ACA GCA GCA TGC ACT GGT TGT GGA AGT TGT CCA AAT GCG CAT ACG 197
Cys Thr Ala Ala Cys Thr Gly Cys Gly Ser Cys Pro Asn Ala His Thr
40 45 50

TGT ATC GAT TCT AAA AAT TGT GTC AGG GCA GAA ACG TGT ACC GAT TCT 245
Cys Ile Asp Ser Lys Asn Cys Val Arg Ala Glu Thr Cys Thr Asp Ser
55 60 65 70

GAA AAT TGT GTC AAG GCA CAT ACA TGT ACT GGA TCT AGA AAC TGT AAT 293
Glu Asn Cys Val Lys Ala His Thr Cys Thr Gly Ser Arg Asn Cys Asn
75 80 85

ACA GCC ATG ACG TGT ACA AAC TCA AAA GAC TGT TTT GAA GCC AAA ACA 341
Thr Ala Met Thr Cys Thr Asn Ser Lys Asp Cys Phe Glu Ala Lys Thr
90 95 100

TGT ACT GAC TCA ACC AAC TGT TAC AAA GCT ACA GCC TGT ACC AAT TCA 389
Cys Thr Asp Ser Thr Asn Cys Tyr Lys Ala Thr Ala Cys Thr Asn Ser
105 110 115

ACA GGA TGT CCC GGA CAT TAAGTTTTTC TATTGTCAAC AATAATAAAA 437
Thr Gly Cys Pro Gly His
120

CACGGAGGGA TAGTCTAAGC TAAACATAA TTGTAAGCTT ACTCTGTATT GTATCCGATC 497

TGTCTCTTTG CCTCCCAAGG ATGATAATTT TGTACTGGGA GCGAAAGGGT TACCGGACAA 557

TAATAATTAA TAAACTAAAA TAATTGATAT AAAAAAAAAA AAAAA 602

(2) INFORMATION FOR SEQ ID NO:19:

(i) SEQUENCE CHARACTERISTICS:

- (A) LENGTH: 124 amino acids
- (B) TYPE: amino acid
- (D) TOPOLOGY: linear

(ii) MOLECULE TYPE: protein

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:19:

Met Ala Phe Lys Thr Cys Gly Phe Ser Lys Lys Trp Leu Ile Ile Ala
1 5 10 15

Val Ile Val Met Cys Leu Cys Thr Glu Cys Tyr Cys Gln Cys Thr Gly
20 25 30

Q. 0

(i) SEQUENCE CHARACTERISTICS:

- (ii) MOLECULE TYPE: cDNA

(A) NAME/KEY: -

- (B) LOCATION: 1..555
(D) OTHER INFORMATION: /note= "consensus thermal hysteresis
protein (THP) cDNA"

AAACAGCGAG	ATAAANAACA	ATANTACANA	AAANTATGNC	NTTCAAAANN	NGTNNTTTTN	60
CAAAAANNTG	GTTANTNATA	GCAGTTATNG	TTATGTGTTT	GTGTANCGAG	TNTNATTGCC	120
ANTGCACTGG	GGNTGCTGAT	TGNACTAGTT	GTACAGNNGC	ATGCACTGGT	TGTGGAANNT	180
GTCCAAATGC	NNNNACGTGT	ANCNNTTCNN	AANATTGTGT	CANGGCANNN	ACATGTACTG	240
GNTCTANANA	NTGTAATANN	GCCNNGACGT	GTACAAANTC	AAAAGNCTGT	TTNGAAGCCA	300
NNACATGTAC	TGACTCAACC	AACTGTTACA	AAGCTACAGC	CTGTACCAAT	TCANCAGGAT	360
GTCCCGGACA	TTANGTTTTT	NTATTGTCAA	CAATNNNATA	AAACANNNNN	NNNNTNNNCT	420
NAGNTAAAC	NNNNNTGTAN	NNNNNNNNNT	GTNTNNNATC	NNNNNTGTCN	CTNNGCNCNC	480
NAAGGANNT	AATTTTGTAC	NGGGAGNGAA	ANGNNTANCN	GACAATAATA	NNNNNNNAAC	540
NNNNNTAATN	NNNAT					555

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: DNA

(ix) FEATURE:

(A) NAME/KEY: -

(B) LOCATION: 1..313

(D) OTHER INFORMATION: /note= "Yl-1 nucleic acid probe used to screen Tenebrio molitor larval fat body lambda-Zap cDNA library"

(xi) SEQUENCE DESCRIPTION: SEQ ID NO:21:

CACTGCACTG	GGGGTGCTGA	TTGTACTAGT	TGTACAGATG	CATGCACTGG	TTGTGGAAAT	60
TGTCCAAATG	CACATACGTG	TACCGATTCC	AAAAATTGTG	TCAAGGCAGC	AACATGTACT	120
GGATCTACAA	AATGTAATAC	CGCCAGGACG	TGTACAAACT	CAAAAGACTG	TTTTGAAGCC	180
AAAACATGTA	CTGACTCAAC	CAACTGTTAC	AAAGCTACAG	CCTGTACCAA	TTCAACAGGA	240
TGTCCCGGAC	ATTAAGTTTT	TCTATTGTCA	ACAATAATAA	AACACACTTA	CTGTTATCTT	300
AGCTAAAACA	TAA					313

(2) INFORMATION FOR SEO ID NO:22:

(i) SEQUENCE CHARACTERISTICS:

(A) LENGTH: 20 amino acids

(B) TYPE: amino acid

(C) STRANDEDNESS:

(D) TOPOLOGY: linear

(ii) MOLECULE TYPE: peptide

(xi) SEQUENCE DESCRIPTION: SEO ID NO:22:

Cys Xaa Xaa Xaa Xaa Xaa Cys Xaa Xaa Cys Xaa Xaa Xaa Cys Xaa Xaa
1 5 10 15

Cys Xaa Xaa Cys
20

SEQ ID NO:1 12 AMINO ACID MOTIF

Cys-Thr-Xaa-Ser-Xaa-Xaa-Cys-Xaa-Xaa-Ala-Xaa-Thr; where Xaa represents any amino acid

SEQ ID NO:2 CONSERVED N-TERMINAL REGION OF THP ISOFORMS

5'-TGCACTGGGG (GC) TGCTGATTG (TC) ACTAGTTGTACAG (CN) (AT) GCATGCACTGG TTGTGGAA (AG) (TC) TGTCCAAATGC-3'

SEQ ID NO:3 N-TERMINAL MOTIF FOR YL-1, YL-2, YL-3 and YL4

Xaa-Cys-Thr-Xaa-Xaa-Xaa-Xaa-Cys-Thr-Xaa-Cys-Thr-Xaa-Xaa-Cys-Thr

SEQ ID NO:4 N-TERMINAL AMINO ACID SEQUENCE OF YL-1, YL-2, YL-3 AND YL-4

(Gln/His)-Cys-Thr-Gly-(Ala/Gly)-Ala-Asp-Cys-Thr-Ser-Cys-Thr-(Ala/Asp/Gly)-Ala-Cys-Thr-Gly-Cys-Gly-(Asn/Ser)-Cys-Pro-Asn-Ala

SEQ ID NO:5 CONSERVED C-TERMINAL REGION OF THP ISOFORMS

5'-CTCAACCAACTGTTACAAAGCTACAGCCTGTACCAATTCA (TA) CAGGATGTCCCGGGA CATTA (AG) -3'

SEQ ID NO:6 5' PCR PRIMER

5'-CATATGCATATGCAATGCACTGGGGGTGCTGA-3'

SEQ ID NO:7 3' PCR PRIMER

5'-AAGCCTAAGCTTTTAATGTCCGGGACATCCTG-3'

SEQ ID NO:8 INTERNAL DOWNSTREAM FACING SEQUENCING PRIMER

5'-AAAGACTGTTTTGAAGCC-3'

SEQ ID NO:9 INTERNAL UPSTREAM FACING SEQUENCING PRIMER

5'-TTCAAAACAGTCTTTTGA-3'

SEQ ID NO:10 NUCLEIC ACID SEQUENCE OF YL-1

TAAACAGCGA GATAAACAAC AATACTACAT AAAACTATGG CGTTCAAAAC
 GTGTGGTTTT TCAAAAAAAT GGTTAGTAAT AGCAGTTATA GTTATGTGTT
 TGTGTACCGA GTGTTATTGC CACTGCACTG GGGGTGCTGA TTGTACTAGT
 TGTACAGATG CATGCACTGG TTGTGGAAAT TGTCCAAATG CACATACGTG
 TACCGATTCC AAAAATTGTG TCAAGGCAGC AACATGTACT GGATCTACAA
 AATGTAATAC CGCCAGACGT GTACAAACTC AAAAGACTGT TTTGAAGCCA
 AAACATGTAC TGACTCAACC AACTGTTACA AAGCTACAGC CTGTACCAAT
 TCAACAGGAT GTCCCGGACA TTAAGTTTTT CTATTGTCAA CAATAATAAA
 ACACACTTAC TGTATCTTA GCTAAACAT AATTGTAAGC TCACTCTGTT
 TTGTATCCTA TCTCACTTAC TGTTATCTTA GCTAAACAT AATTGTAAGC
 TCACTCTGTT TTGTATCCTA TCTGTCTCTG CCTCCGAAGG ATGATAATTT
 TGTACTGGGA GCGAAGGTT TATCCGACAA TAATAAACTA AAATAATTGA
 TATAAAAAAA AAAAAAAA

SEQ ID NO:11 AMINO ACID SEQUENCE OF YL-1

MAFKTCGFSKKWLVIIVIMCLCTECYCHCTGGADCTSCTDA CTGCGNCPNAHT
 CTDSKNCVKAAT CTGSTKCNART CTNSKDCFEAKT CTDSTNCKYKATA CTNSTGCPGH

SEQ ID NO:12 NUCLEIC ACID SEQUENCE OF YL-2

AAACAATATT ACAAAAAACT ATGGCATTCA AAACGTGTGG TTTTCAAAA
 AAATGGTTAG TAATAGCAGT TATAGTTATG TGTTTGTGTA CCGAGTGTTA
 TTGCCAATGC ACTGGGGGTG CTGATTGCAC TAGTTGTACA GGAGCATGCA
 CTGGTTGTGG AAACGTGCCA AATGCAGTAA CGTGTACCAA TTCTCAACAT
 TGTGTCAAGG CAAATACATG TACTGGGTCT ACAGATTGTA ATACAGCCCA
 GACGTGTACA AACTCAAAAG ACTGTTTTGA AGCCAACACA TGTACTGACT
 CAACCAACTG TTACAAAGCT ACAGCCTGTA CCAATTCATC AGGATGTCCC
 GGACATTAAAG TTTTCTATT GTCAACAATC ATAAACACA ATTATTGTTA
 GCTAAGTTAA AACTCTGTAT TGTATCCGAT CTCAATTATT GTTAGCTAAG
 TTAAACTCT GTATTGTATC CGATCTATAA ACTAAATAA TTGATATAAA
 AAAAAAAAAA AA

SEQ ID NO:13 NUCLEIC ACID SEQUENCE OF YL-3

AAACAACAAT ATTACAAAAA ACTATGGCAT TCAAAACGTG TGGTTTTTCA
 AAAAAATGGT TAATAATAGC AGTTATAGTT ATGTGTTTGT GTACCGAGTG
 TTATTGCCAA TGCACGGGGG GTGCTGATTG TACTAGTTGT ACAGCAGCAT
 GCACTGGTTG TGGAAGTTGT CCAAATGCGC ATACGTGTAC CGATTCTAAA
 AATTGTGTCA GGGCAGAAAC GTGTACCGAT TCTGAAAATT GTGTCAAGGC
 ACATACATGT ACTGGATCTA GAAACTGTAA TACAGCCATG ACGTGTACAA
 ACTCAAAAGA CTGTTTTGAA GCCAAACAT GTACTGACTC AACCAACTGT
 TACAAAGCTA CAGCCTGTAC CAATTCAACA GGATGTCCCG GACATTAAGT
 TTTTCTATTG TCAACAATAA TAAACACGG AGGGATAGTC TAAGCTAAAA
 CATAATTGTA AGCTTACTCT GTATTGTATC CGATCTGTCT CTTTGCCTCC
 CAAGGATGAT AATTTTGTAC TGGGAGCGAA AGGGTTACCG GACAATAATA
 ATTAATAAAC TAAATAATTG ATAAAAAAA AAAAAAA

SEQ ID NO:14 NUCLEIC ACID SEQUENCE OF SEQUENCE OF YL-4

CAAAAAGTA TGTCAATCAA AATAAGTACT TTTACAAAAA TCTGGTTAAT
 TATAGCAGTT ATGTTATGTG TTTGTGTAAC GAGTATAATT GCCAGTGCAC
 TGGGGCTGCT GATTGTACTA GTTGTAACAGC AGCATGCACT GGTGTGGAA
 ACTGTCCAAA TGCAATAACG TGTACCGGTT CTAAAAATTG TGTCAGGGCA
 ACAACATGTA CTGGGTCTAC AAAGTGAAT GAGCCACGAC GTGTACAAAT
 CAAAAGGCTG TTTAGAAGCC ACAACATGTA CTGGGTCTAC AACTGTTCAT
 AGAGCACGAC GTGTACAAAT TCAAAAGACT GTTTTGAAGC CACAACATGT
 ACTGGCTCAA GCAACTGTTA CACTGCTACA ACATGTACTA ACTCAACCAA
 CTGTTACAAA GCTACAGCCT GTACCAATTC AACAGGATGT CCCGGACATT
AGGTTTTTTT ATTGTCAACA ATAAAATAAA ACAAACTGT TCTTATCTAA
 GCTAAAACAT AAATGTAAAC GTTAATTTGT ATTCTATCCG ATCTGTCCCT
 TTGCGCCCTA AGGATAATTT TGTACAGGGA GAGAAAAGGC TATCGGACAA
 TAATAAACAT TGTTAATATA CATAAAAAAA AAAAAAA

SEQ ID NO:15 NUCLEIC ACID SEQUENCE OF 5-15

AAACAGCGAG ATAAACAACA ATATTACAAA AAACATGGC ATTCAAAACG
 TGTGGTTTTT CAAAAAATG GTTAATAATA GCAGTTATAG TTATGTGTTT
 GTGTACCGAG TGTTATTGCC AATGCACTGG GGGTGCTGAT TGTACTAGTT
 GTACAGCAGC ATGCACTGGT TGTGGAAGTT GTCCAAATGC GCATACGTGT
 ATCGATTCTA AAAATTGTGT CAGGGCAGAA ACGTGTAACG ATTCTGAAAA
 TTGTGTCAAG GCACATACAT GTACTGGATC TAGAACTGT AATACAGCCA
 TGACGTGTAC AAACTCAAAA GACTGTTTTG AAGCCAAAAC ATGTACTGAC
 TCAACCAACT GTTACAAAGC TACAGCCTGT ACCAATTCAA CAGGATGTCC
 CGGACATTAA GTTTTCTAT TGTCAACAAT AATAAAACAC GGAGGGATAG
 TCTAAGCTAA AACATAATTG TAAGCTTACT CTGTATTGTA TCCGATCTGT
 CTCTTTGCCCT CCCAAGGATG ATAATTTTGT ACTGGGAGCG AAAGGGTTAC
 CGGACAATAA TAATTAATAA ACTAAAATAA TTGATATAAA AAAAAAAAAA
 AA

SEQ ID NO:16 NUCLEIC ACID PROBE USED TO SCREEN cDNA LIBRARY

CACTGCACTG GGGGTGCTGA TTGTACTAGT TGTACAGATG CATGCACTGG
 TTGTGGAAAT TGTCCAAATG CACATACGTG TACCGATTCC AAAAATTGTG
 TCAAGGCAGC AACATGTACT GGATCTACAA AATGTAATAC CGCCAGACGT
 GTACAAACTC AAAAGACTGT TTTGAAGCCA AAACATGTAC TGAICTAACC
 AACTGTTACA AAGCTACAGC CTGTACCAAT TCAACAGGAT GTCCCGGACA
 TTAAGTTTTT CTATTGTCAA CAATAATAAA ACACACTTAC TGTTATCTTA
 GCTAAAACAT AA

ATG = initiating met

TAA = stop codon